International Journal of Education, Humanities and Social Sciences

*Article*

# A Practical Study on How AI Assistance Can Enhance High School Students' Information Retrieval Skills

**Ke Zhang** [1,*]

[1] Sichuan Zhongjiang Cangshan Middle School, Deyang, China
* Correspondence: Ke Zhang, Sichuan Zhongjiang Cangshan Middle School, Deyang, China

**Abstract:** The continuous evolution of artificial intelligence technology has fundamentally transformed the operational paradigms and application logic of contemporary information retrieval, presenting unprecedented opportunities for reforming information literacy education in high schools. Within modern intelligent learning environments, students' information retrieval practices frequently reveal significant challenges. These include limited search strategies, insufficient critical analysis skills, and a notably low efficiency in practical knowledge application. Consequently, traditional teaching approaches have become increasingly inadequate for meeting the complex demands of digital education in the twenty-first century. To address these critical gaps, this study adopts a human-computer collaborative educational perspective, meticulously integrating students' cognitive development characteristics with real-world teaching contexts. It systematically examines the underlying mechanisms by which artificial intelligence enhances information retrieval capabilities. Furthermore, the research identifies both the strengths and inherent limitations of artificial intelligence tools when deployed in basic education settings. Based on these empirical insights, the study establishes a comprehensive, intelligent retrieval training framework specifically tailored to diverse student needs, and proposes actionable teaching optimization strategies for educators. By focusing on the core challenges inherent in developing robust information retrieval competencies, this research ultimately aims to cultivate precise, intelligent, and highly critical information retrieval and application skills. In doing so, it provides a strategic roadmap for solidifying the foundational pillars of information literacy, ensuring that modern high school students are adequately prepared for future academic and professional endeavors in an increasingly automated world.

**Keywords:** artificial intelligence; information retrieval; information literacy; secondary education; teaching strategies

Received: 20 April 2026
Revised: 02 June 2026
Accepted: 12 June 2026
Published: 17 June 2026

**Copyright:** © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

## 1. Introduction

The deep integration of digital intelligence technologies with basic education has significantly transformed the landscape of network information resources, driving them toward massive scale, fragmentation, and diversification. In this evolving context, information retrieval skills have emerged as fundamental core competencies for high school students. These skills enable students to engage in independent inquiry and achieve deep learning, forming an essential part of their literacy for building lifelong learning systems and adapting to the ongoing digital transformation in education. For many years, information retrieval instruction in Chinese high schools has predominantly relied on traditional models that focus on keyword matching and static webpage filtering. These conventional approaches are characterized by rigid teaching frameworks, limited training dimensions, and poor adaptability to diverse contexts. Consequently, students often face challenges such as insufficient search accuracy, inadequate information discernment abilities, low utilization rates of search outcomes, and difficulties in navigating complex digital learning environments. The advent of generative AI and large language model technologies has introduced innovative retrieval methods, including

semantic analysis, intelligent filtering, and conversational interactive searches. These advancements address the technical limitations and cognitive barriers of traditional information retrieval methods, offering new technological support and practical pathways to enhance high school students' information retrieval capabilities [1].

## 2. Current Status and Existing Issues of High School Students' Information Retrieval Skills

High school students demonstrate rigid thinking patterns in information retrieval, relying predominantly on traditional keyword-based methods and strategies. This limited approach often results in inefficiencies, as students struggle to adapt to diverse retrieval techniques due to insufficient systematic instructional guidance. Consequently, their retrieval processes frequently yield redundant information and fail to meet the demands of advanced learning tasks, which require deeper analytical engagement. A significant issue lies in their inability to critically evaluate the quality of information; when faced with mixed-quality online content, students lack robust mechanisms for filtering and verifying data. This often leads to the misuse of inaccurate information and difficulty in resolving contradictory sources, ultimately undermining the academic rigor of their research [2]. Moreover, students tend to focus excessively on acquiring information rather than applying it effectively, resulting in fragmented knowledge accumulation without meaningful transformation into practical understanding. The instruction provided in high schools further exacerbates these challenges, as it suffers from outdated content, overly monotonous teaching models, and insufficient attention to individual student differences, all of which impede the development of comprehensive retrieval skills necessary for academic success.

## 3. The Internal Mechanisms Behind AI-Assisted Enhancement of High School Students' Information Retrieval Skills

### *3.1. Reconstruct the Retrieval Paradigm to Reduce Cognitive Retrieval Load*

Traditional keyword search systems rely heavily on mechanical matching logic, requiring students to possess advanced skills in keyword extraction, sentence construction, and logical combination. Even minor errors in these processes can result in ineffective searches. In contrast, AI-powered search tools, driven by large language models, have transformed this paradigm by introducing a conversational, semantic, and interactive framework that overcomes the technical limitations of traditional methods. These advanced tools utilize sophisticated natural language understanding and intelligent semantic analysis technologies to accurately interpret students' vague or fragmented information needs [1, 3]. They autonomously break down complex topics, refine search logic, and broaden search dimensions, effectively addressing issues such as limited search perspectives and imprecise keyword usage. Furthermore, AI tools excel in organizing and integrating vast amounts of search results, performing tasks such as structured organization, logical synthesis, and key point extraction. By automating these preliminary filtering processes, they significantly reduce the cognitive load associated with surface-level information processing. This allows students to allocate their cognitive resources more effectively to higher-order cognitive tasks, such as critical information evaluation, deep reasoning, and knowledge reconstruction. As a result, these tools not only enhance the efficiency of information retrieval but also elevate students' overall search capabilities to more advanced levels.

### *3.2. Enhancing Precise Search Capabilities and Refining the Search Strategy Framework*

Artificial intelligence retrieval tools leverage massive data resources and deep learning algorithms to achieve precise matching between search queries and high-quality academic materials, intelligently optimize search scopes, and assist students in developing systematic and standardized retrieval strategies [4]. Unlike traditional mechanical matching methods, AI-powered retrieval enables multi-dimensional semantic expansion, contextual extension, and scenario-specific adaptation around core search

themes, delivering authoritative, up-to-date, and high-quality information tailored to high school educational contexts while filtering out redundant, irrelevant, or low-quality content. These tools dynamically adjust search dimensions in complex academic retrieval scenarios, incorporating diverse perspectives and guiding students in mastering professional techniques such as topic decomposition, hierarchical searching, related searches, and precise source tracing. This approach overcomes the limitations of conventional retrieval methods by fostering a more nuanced understanding of search methodologies. Through prolonged collaborative use with AI tools, students gradually develop intelligent retrieval thinking patterns, continuously refine their personal search strategies, and significantly enhance the accuracy, comprehensiveness, and efficiency of information retrieval. Furthermore, this iterative process cultivates critical thinking and adaptability, equipping students with essential skills for academic and professional success.

### *3.3. Strengthen Critical Thinking and Enhance Information Analysis Capabilities*

Beyond assisting students in efficiently accessing information, artificial intelligence technology plays a pivotal role in cultivating critical information literacy and rational analysis skills. Through structured human-computer interaction training, AI effectively addresses the widespread challenge of weak information discernment among high school students [4, 5]. Advanced AI search tools offer functionalities such as source tracing, authoritative annotation, timeliness verification, and risk alerts, empowering students to distinguish between academic publications, official reports, and social media content while establishing standardized frameworks for evaluating information. Additionally, AI facilitates multi-round interactive analysis, perspective comparison, and logical validation, enabling students to engage in immersive human-computer dialogues. These dialogues allow for cross-checking, comparing, and organizing diverse search results, progressively equipping students with professional methods for verifying authenticity, selecting valuable content, and conducting logical reasoning. This systematic approach not only fosters critical thinking in information retrieval but also reduces dependence on automated searches, significantly enhancing the scientific rigor and accuracy of students' information assessment processes.

### *3.4. Facilitating Knowledge Transformation and Closed-Loop Retrieval Application Scenarios*

Artificial intelligence-based retrieval tools possess robust capabilities in information integration, organization, and restructuring, effectively addressing the core challenge of insufficient information transformation skills among high school students by establishing a comprehensive practical cycle of "retrieval--filtration--integration--application." These tools are particularly effective in resolving common issues such as fragmented information retrieval and disorganized logical structures. By applying AI tools across specific learning contexts, such as research projects, academic writing, and subject exploration, students can benefit from the ability to categorize, organize, logically restructure, and extract key insights from vast amounts of search data [6]. This process generates structured, systematic information outputs that provide precise support for advanced learning activities. Moreover, based on users' retrieval needs and application objectives, AI systems recommend evidence-based approaches to information integration, knowledge transfer strategies, and optimization methods. These recommendations guide students in systematically organizing fragmented information and internalizing external knowledge. Through regular, scenario-driven usage, students gradually master essential techniques for information integration and knowledge transfer, fostering the coordinated development of both retrieval proficiency and knowledge application skills. This iterative process not only enhances their academic performance but also equips them with critical lifelong learning competencies.

## 4. Practical Approaches to Cultivating High School Students' Information Retrieval Skills with AI Assistance

### *4.1. Establishing a Hierarchical AI Retrieval Teaching System*

By integrating the cognitive development patterns of high school students with individual variations in information retrieval capabilities, we have developed a tiered AI retrieval teaching framework that addresses both content gaps and methodological shortcomings in traditional information literacy education. At the foundational level, instruction focuses on core AI retrieval applications, covering tool operation, natural language search design, and basic thematic searches for all students. This foundational training enables students to master fundamental retrieval techniques and overcome the limitations of conventional search thinking, such as reliance on overly simplistic keyword searches. The advanced level emphasizes strategy optimization through specialized training modules addressing complex academic scenarios. These include topic decomposition, semantic expansion, multidimensional searching, and cross-validation, which collectively equip students with diverse intelligent retrieval strategies and enhance search accuracy and comprehensiveness. The advanced-level curriculum prioritizes higher-order information literacy development by incorporating research projects, interdisciplinary exploration, and innovative practices. These activities include human-machine collaborative searching, critical information analysis, knowledge reconstruction, and result refinement, fostering intelligent retrieval thinking and sophisticated learning competencies. By integrating AI retrieval training into regular classroom instruction across disciplines, this approach achieves seamless integration of smart technologies with subject-based education. Furthermore, it promotes lifelong learning skills, ensuring students are better prepared for the demands of a rapidly evolving digital landscape.

### *4.2. Establishing a Human-Machine Collaborative Retrieval Training Model*

To address the issue of cognitive inertia among students caused by excessive reliance on AI tools, it is essential to establish a human-AI collaborative retrieval training model characterized by "student-led, AI-assisted, and thinking-centered" approaches, balancing the dialectical relationship between technological empowerment and core competency development. Clear division of responsibilities should be defined: students should independently handle key cognitive tasks such as topic decomposition, requirement identification, strategy formulation, information analysis, and outcome optimization, while repetitive mechanical tasks—including initial information screening, content integration, resource expansion, and format organization—should be supported by AI tools. Standardized collaborative retrieval practice tasks should be incorporated into daily teaching activities, guiding students to develop their own search strategies and frameworks, execute searches using AI tools, then manually verify, analyze, refine, and enhance the generated results. Furthermore, educators should emphasize the importance of critical thinking and adaptability, encouraging students to approach AI-generated outputs with a discerning mindset. Regular collaborative training not only fully leverages the efficiency advantages of AI technology but also preserves students' independent thinking processes and critical judgment skills, fundamentally preventing technological dependency and achieving substantial improvement in core retrieval competencies.

### *4.3. Strengthening the Cultivation of Information Criticism and Retrieval Ethics*

Due to inherent technical limitations of large language models, AI-powered information retrieval commonly faces application risks such as content inaccuracies, data delays, fabricated results, and logical inconsistencies. Therefore, it is essential to enhance students' critical information analysis skills and cultivate their ethical awareness regarding information retrieval practices during teaching, while establishing a standardized framework for intelligent search applications. The curriculum should incorporate a risk-awareness module that systematically addresses core issues including technical flaws in large language models, temporal inaccuracies in information, and insufficient source credibility, helping students adopt the principle of "always verifying AI retrieval outcomes." A standardized verification process must be implemented, requiring students to use authoritative databases, official platforms, and professional literature sources to trace origins, conduct cross-references, and verify the timeliness of AI-generated results, thereby preventing academic misconduct involving direct adoption

of generated content. Additionally, education on information ethics and academic standards should be integrated to guide students in using AI tools responsibly and rationally, avoiding plagiarism, misuse, or improper replication of information. This approach fosters a culture of ethical research and responsible digital usage. By embedding these practices into the educational framework, students can achieve simultaneous improvement in both retrieval capabilities and information literacy, ensuring they are well-prepared for the challenges of the digital age.

*4.4. Establish a Diversified Evaluation System for Retrieval Capabilities*

This initiative moves beyond traditional, singular evaluation models for search results by introducing an advanced assessment system that incorporates process-oriented, diverse, and comprehensive evaluation criteria. This approach aims to achieve educational goals such as enhancing learning through assessment and promoting academic excellence. The system evaluates five core dimensions: the design of search strategies, execution of search processes, analysis and interpretation of information, integration and application of outcomes, and adherence to ethical standards in information retrieval. It not only assesses the accuracy and contextual relevance of search results but also emphasizes critical process-related skills, including search reasoning, strategic application, and analytical thinking. A multi-faceted evaluation framework is employed, combining self-assessment by students, peer reviews within groups, instructor feedback, and AI-driven data monitoring. The AI platform continuously records behavioral data, such as query formulation, dimension selection, strategy adjustments, and outcome optimization, enabling real-time tracking and precise evaluation throughout the search process. Furthermore, a robust feedback loop is established to address common challenges like limited strategy diversity, inadequate analysis, and weak integration skills. This feedback mechanism provides customized practical training tasks, helping students enhance their competencies and refine their knowledge and skills in information retrieval, thereby fostering a more holistic academic development.

## 5. Existing Challenges in AI-Assisted Retrieval Practices

*5.1. Technical Dependence Leads to Mental Inertia.*

The user-friendly nature of AI retrieval tools can easily foster a rigid technological dependency among students, leading to detrimental educational outcomes such as weakened search-oriented thinking and diminished independent critical reasoning skills. Some students rely excessively on AI tools to complete the entire information retrieval process, neglecting essential cognitive steps like independent topic analysis, strategic planning, and information filtering, and instead directly applying AI-generated structured outputs. This over-reliance on AI tools not only diminishes their ability to engage in creative problem-solving but also reduces their capacity to adapt to complex, real-world scenarios that require nuanced judgment. Over time, this approach causes students to gradually lose their core abilities in independent information retrieval and autonomous thinking [7]. Persistent technological dependence prevents effective development of fundamental competencies---including information retrieval strategies, analytical judgment, and logical reasoning---creating an educational paradox where technological empowerment actually undermines core literacy, hindering the sustained and advanced growth of high school students' information retrieval capabilities and broader intellectual development.

*5.2. AI Retrieval Inherently Carries the Risk of Information Bias.*

Current large language model technology remains in a phase of continuous refinement, yet it is plagued by common issues such as content hallucinations, delayed data updates, biased perspectives, and logical flaws, which introduce uncertainty and potential application risks into AI retrieval outcomes. Due to inherent limitations in cognitive capacity, knowledge base, and analytical skills, high school students often face significant challenges in accurately identifying erroneous information or logical

inconsistencies in AI-generated content. This makes them highly susceptible to being misled by one-sided or false information, thereby forming incorrect knowledge perceptions and academic viewpoints. Moreover, the training datasets of most commercial AI tools frequently suffer from shortcomings, including outdated timeliness, insufficient academic rigor, and low-quality resources. These deficiencies render such tools inadequate for meeting the high standards required for high school research projects and academic inquiry. Consequently, the professionalism, reliability, and rigor of retrieval results cannot be effectively ensured, posing a substantial barrier to fostering critical thinking and academic excellence among students.

### *5.3. Insufficient Teaching Adaptability and Resource Support*

Currently, most regular high schools in China have not yet developed a fully mature and comprehensive AI-powered retrieval teaching resource system. The availability of specialized courses, practical training materials, and instructional case studies designed to align with high school students' cognitive levels and subject-specific teaching needs remains limited. This gap significantly impacts the ability of educators to integrate AI technologies effectively into their teaching practices. Furthermore, frontline educators often lack access to systematic training programs that would enhance their understanding of AI retrieval systems, including their technical principles, classroom applications, and associated risk management strategies. This deficiency hinders their capacity to provide professional and consistent instructional guidance or to address the personalized challenges that may arise during collaborative student-human search activities. Additionally, disparities in the allocation of intelligent teaching resources across regions and schools exacerbate the issue. Some institutions lack compliant, high-quality AI retrieval platforms suitable for educational use, further impeding the widespread adoption of AI-assisted retrieval instruction and limiting the potential benefits of technology-driven education.

## 6. Optimization Strategies for Enhancing High School Students' Information Retrieval Skills with AI Assistance

### *6.1. Standardize Human-Machine Collaborative Retrieval Guidelines to Overcome Cognitive Inertia*

Clarify the auxiliary teaching role of AI-powered retrieval tools, establish standardized guidelines for human-machine collaborative search implementation, and address students' technological dependency issues at the instructional level. In classroom settings, it is essential to strictly enforce standardized search procedures requiring students to adhere to the core workflow of "self-conceptualization -- AI-assisted search -- manual verification and optimization -- knowledge integration and application." This approach ensures that students engage in meaningful learning while preserving ample opportunities for independent thinking and critical evaluation. To cater to diverse student needs, differentiated search tasks should be designed based on varying competency levels: basic tasks should primarily be completed independently to build foundational skills, while more complex inquiry tasks can incorporate moderate AI assistance. This strategy helps guide students in understanding the appropriate usage boundaries and application scope of intelligent tools. Furthermore, regular specialized training sessions on traditional search methods without AI support should be conducted to reinforce students' fundamental search skills and independent reasoning abilities. This dual approach fosters the coordinated development of both conventional search competencies and AI-driven search literacy, ensuring students are well-equipped for future academic and professional challenges.

### *6.2. Establish a Multi-Level Verification Mechanism to Mitigate the Risk of Information Bias*

Establishing a robust three-tiered information verification mechanism is essential to mitigate the risks of information bias in AI-powered searches. This mechanism should include "AI preliminary screening, manual re-examination, and authoritative validation,"

ensuring a systematic approach to verifying information. Students should be encouraged to adopt a cautious and rigorous mindset when retrieving professional information [8, 9]. All intelligent search results must undergo thorough multi-dimensional verification using authoritative academic platforms, official databases, and specialized literature sources to confirm their authenticity, timeliness, and credibility. A cross-referencing approach should be implemented, guiding students to integrate various intelligent search engines with traditional ones for comprehensive searches. By comparing and analyzing data from multiple sources, they can effectively eliminate one-sided or erroneous information, significantly improving the accuracy and reliability of their search outcomes. For high-precision contexts such as academic research and project studies, stringent information selection criteria should prioritize authoritative, cutting-edge, and high-quality resources tailored to the specific needs of high school education.

*6.3. Improve the Teaching Resource System and Enhance Faculty Capacity Building*

In alignment with the General Senior High School Curriculum Standards and requirements for developing students' core competencies, systematic and scenario-based AI-powered retrieval courses have been designed to cater to diverse school contexts. These courses incorporate high-quality teaching resources, including subject-specific retrieval examples, tiered practical exercises, and ethical guidelines, to strengthen the intelligent retrieval education framework. Emphasizing inquiry-oriented subjects such as Chinese, History, Biology, and Geography, specialized human-machine collaborative retrieval teaching cases have been developed to enable seamless integration of AI-driven retrieval into everyday classroom instruction. To further support this initiative, teacher training programs have been enhanced through regular workshops focusing on AI retrieval technologies, instructional methodologies, and risk management strategies. These efforts aim to comprehensively improve educators' proficiency in delivering intelligent teaching guidance while maintaining professional accuracy. Moreover, campus-level intelligent teaching resource allocation has been optimized by deploying compliant and stable AI retrieval platforms tailored for primary and secondary school environments [3, 10]. These platforms provide robust hardware and technical support, ensuring the sustainable implementation of AI-enhanced teaching practices and fostering a technologically enriched educational ecosystem.

*6.4. Deepen Scenario-Based Practical Training to Ensure Capability Implementation*

Leveraging the diversified teaching approaches and practical scenarios of high schools, we conduct regular, scenario-based intelligent retrieval training to transform students' retrieval skills from theoretical understanding into practical competencies. By integrating real-world learning contexts such as research projects, disciplinary exploration, social practice, and innovation competitions, we design targeted human-machine collaborative retrieval exercises that guide students to continuously refine retrieval strategies while solving practical problems. This approach enhances their abilities in information identification, integration, reconstruction, and comprehensive application. Furthermore, we establish personalized retrieval competency portfolios that dynamically document students' performance across various scenarios, identify skill gaps, and track improvement progress. These portfolios enable tailored, precision-driven development by providing actionable insights into individual learning trajectories [11–13]. This sustained, scenario-oriented training empowers students to master core methods of human-machine collaborative retrieval and progressively develop advanced information retrieval capabilities and comprehensive information literacy, ensuring they are well-equipped to navigate the complexities of the digital age.

## 7. Conclusion

The widespread application of artificial intelligence technology has opened up new avenues for cultivating information retrieval skills among high school students, effectively addressing practical challenges in traditional teaching approaches such as rigid methodologies, one-sided competency development, and insufficient search efficiency. By

enabling paradigm restructuring, optimizing instructional strategies, fostering critical thinking, and empowering knowledge transformation, this approach holistically enhances the quality of students' information retrieval capabilities. However, while AI-enhanced search instruction offers significant educational advantages, its practical implementation still encounters challenges, including over-reliance on technology, risks of information bias, and limitations in instructional adaptability. To address these issues, this study establishes an integrated training framework that incorporates tiered instruction, human-machine collaboration, ethical guidance, and diversified evaluation systems. These strategies aim to achieve a balanced integration of technological empowerment and competency development. Future teaching practices should prioritize deeper integration of AI technology with information retrieval education, standardize collaborative search protocols, enhance instructional resources and faculty training systems, and support students in developing intelligent, critical, and systematic search competencies. By doing so, modern high school education can comprehensively enhance students' core information literacy, equipping them with the skills necessary to navigate the complexities of the digital age.

## References


1. H. Julien and S. Barker, "How high-school students find and evaluate scientific information: A basis for information literacy skills development," *Library & Information Science Research*, vol. 31, no. 1, pp. 12–17, 2009.
2. R. Stuart J, *Artificial intelligence*, 2025.
3. E. B. Hunt, *Artificial intelligence*. Academic Press, 2014.
4. J. H. Fetzer, "What is artificial intelligence?," in *Artificial intelligence: Its scope and limits*, Dordrecht: Springer Netherlands, pp. 3–27, 1990.
5. L. Shukla, J. N. Singh, P. Johri, and A. Kumar, "Artificial intelligence in information retrieval," in *2022 4th International Conference on Advances in Computing, Communication Control and Networking (ICAC3N)*, IEEE, Dec. 2022, pp. 1–5.
6. W. P. Henry and P. H. Winston, *Artificial intelligence*. Addison Wesley Longman Publishing Co., Inc., 2004.
7. Y. Jiang, X. Li, H. Luo, S. Yin, and O. Kaynak, "Quo vadis artificial intelligence?," *Discover Artificial Intelligence*, vol. 2, no. 1, p. 4, 2022.
8. W. Ertel, *Introduction to artificial intelligence*. Springer Nature, 2024.
9. M. A. Boden, Ed., *Artificial intelligence*. Elsevier, 1996.
10. L. C. Smith, "Artificial intelligence in information retrieval systems," *Information Processing & Management*, vol. 12, no. 3, pp. 189–222, 1976.
11. P. Hamet and J. Tremblay, "Artificial intelligence in medicine," *Metabolism*, vol. 69, pp. S36–S40, 2017.
12. J. J. McCarthy and M. L. Minsky, *Artificial intelligence*. Research Laboratory of Electronics (RLE) at the Massachusetts Institute of Technology (MIT), 1962.
13. J. Holmes, L. Sacchi, and R. Bellazzi, "Artificial intelligence in medicine," *Ann R Coll Surg Engl*, vol. 86, no. 86, pp. 334–338, 2004.


**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of Publisher and/or the editor(s). Publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.